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(12) UK Patent Application (19) GB (11) 2 031 361 A

(21) Application No 7840863  
(22) Date of filing 14 Oct 1978  
(23) Claims filed 10 Jul 1979  
(23) Claims filed 28 Aug 1979  
(43) Application published  
23 Apr 1980

(51) INT CL<sup>3</sup>  
B63B 35/02

(52) Domestic classification  
B7V HS

(56) Documents cited  
GB 1490870  
GB 1362865  
GB 1281285  
US 3660807A

(58) Field of search  
B7V

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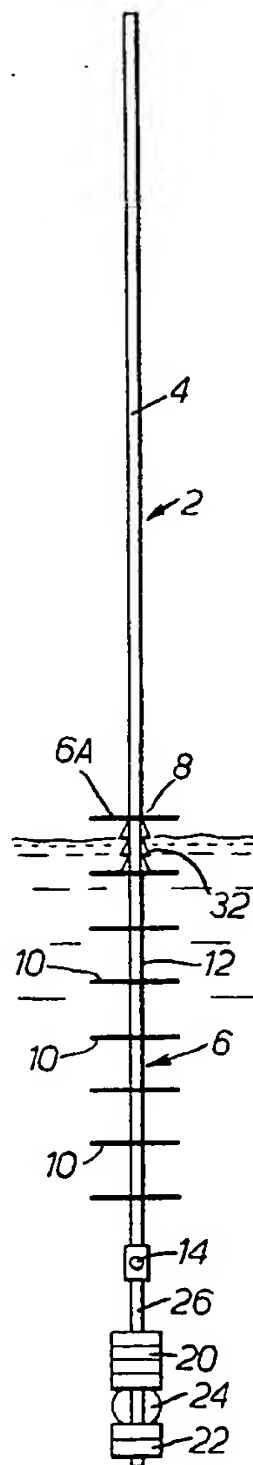
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(54) Hydrodynamic Devices

(57) A hydrodynamic device 2 comprising first and second parts 4, 6 which are connected together such that the first part is movable from a storage position in which it lies adjacent to the second part to an operable position in which it upstands from and extends from one end

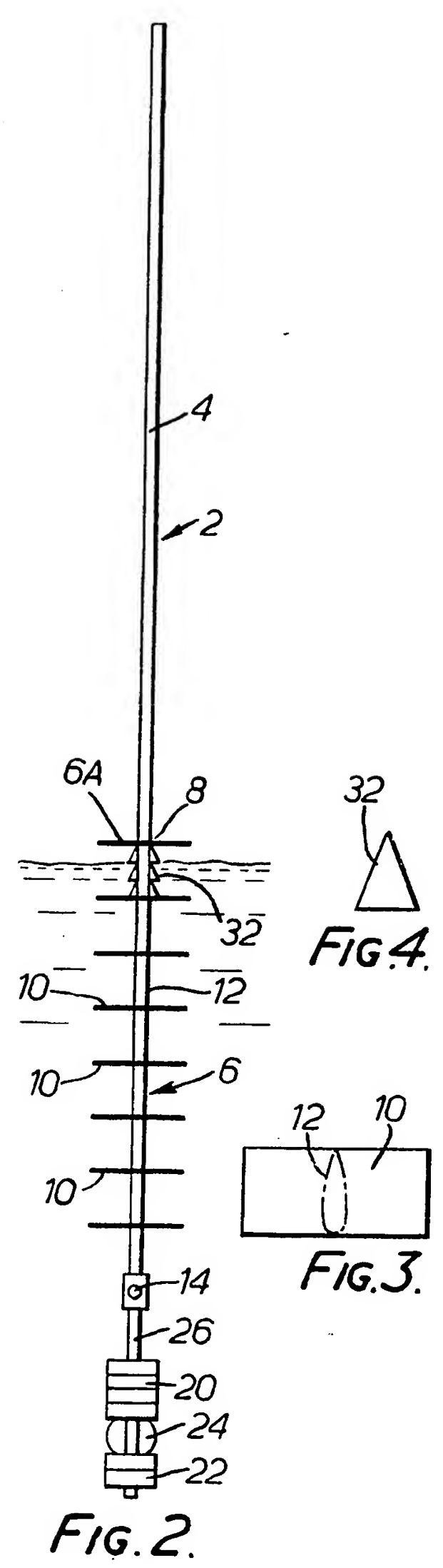
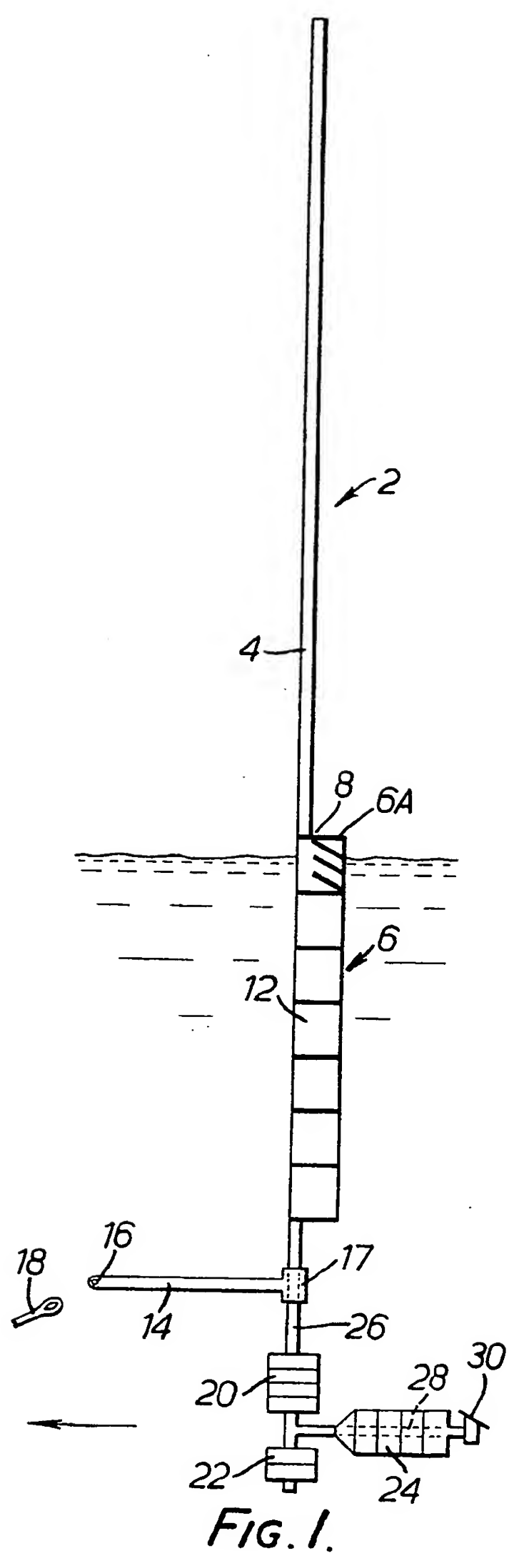
portion of the second part, the second part comprising an elongate member having (a) a plurality of transversely extending hydrofoil elements 10, and (b) towing means 14 for enabling a connection to be made between the hydrodynamic device and a towing vessel whereby the hydrodynamic device can be towed in water with the first part visible above the water and the second part submerged.

FIG. 2.

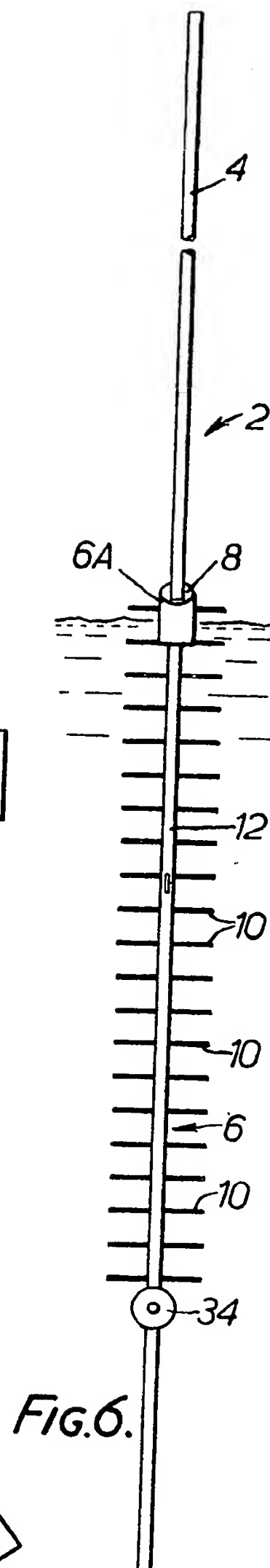
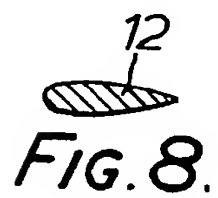
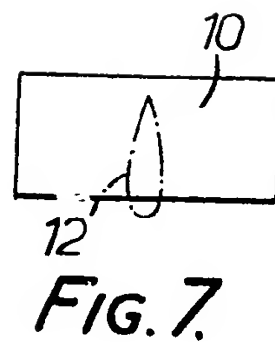
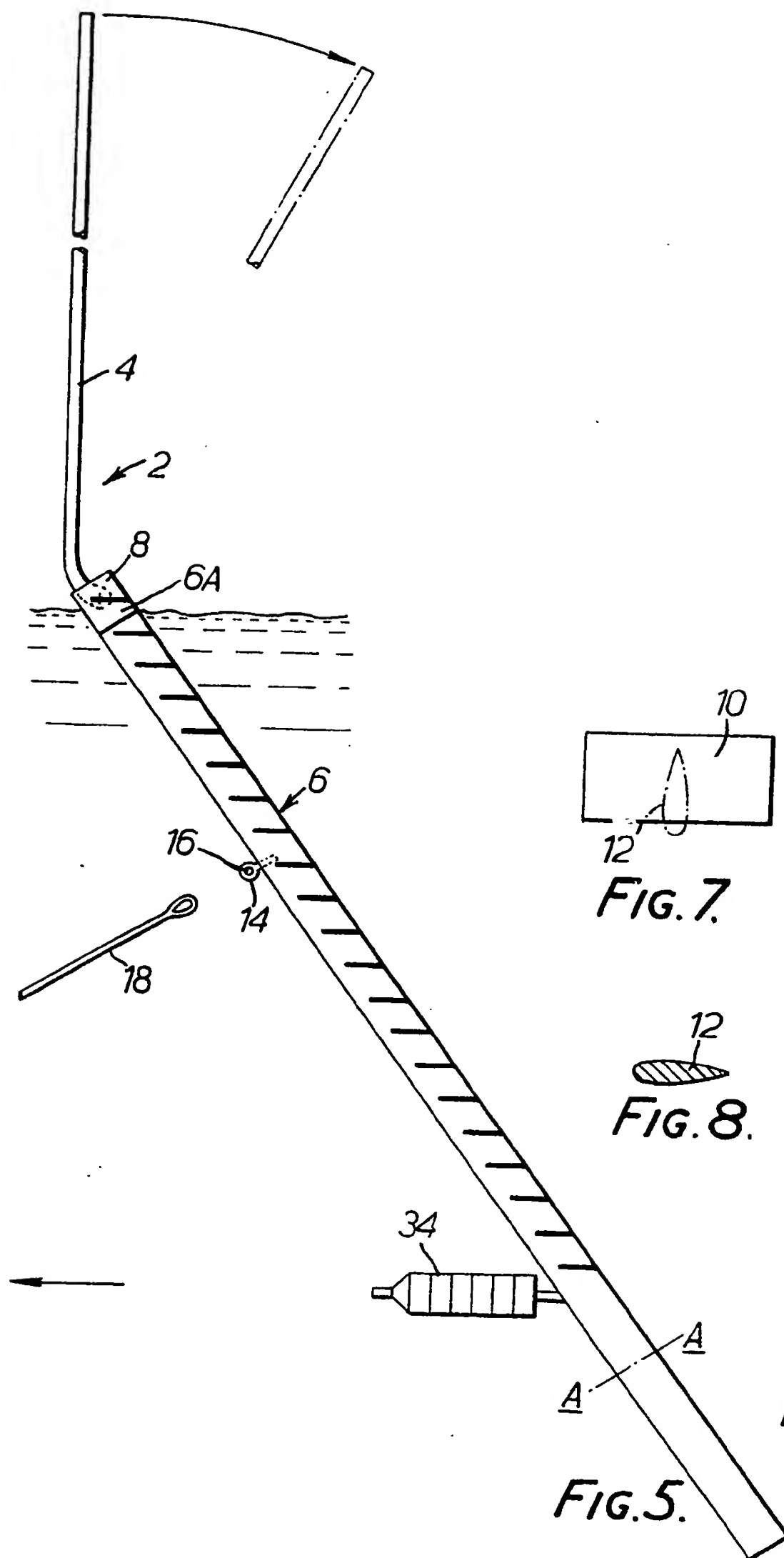


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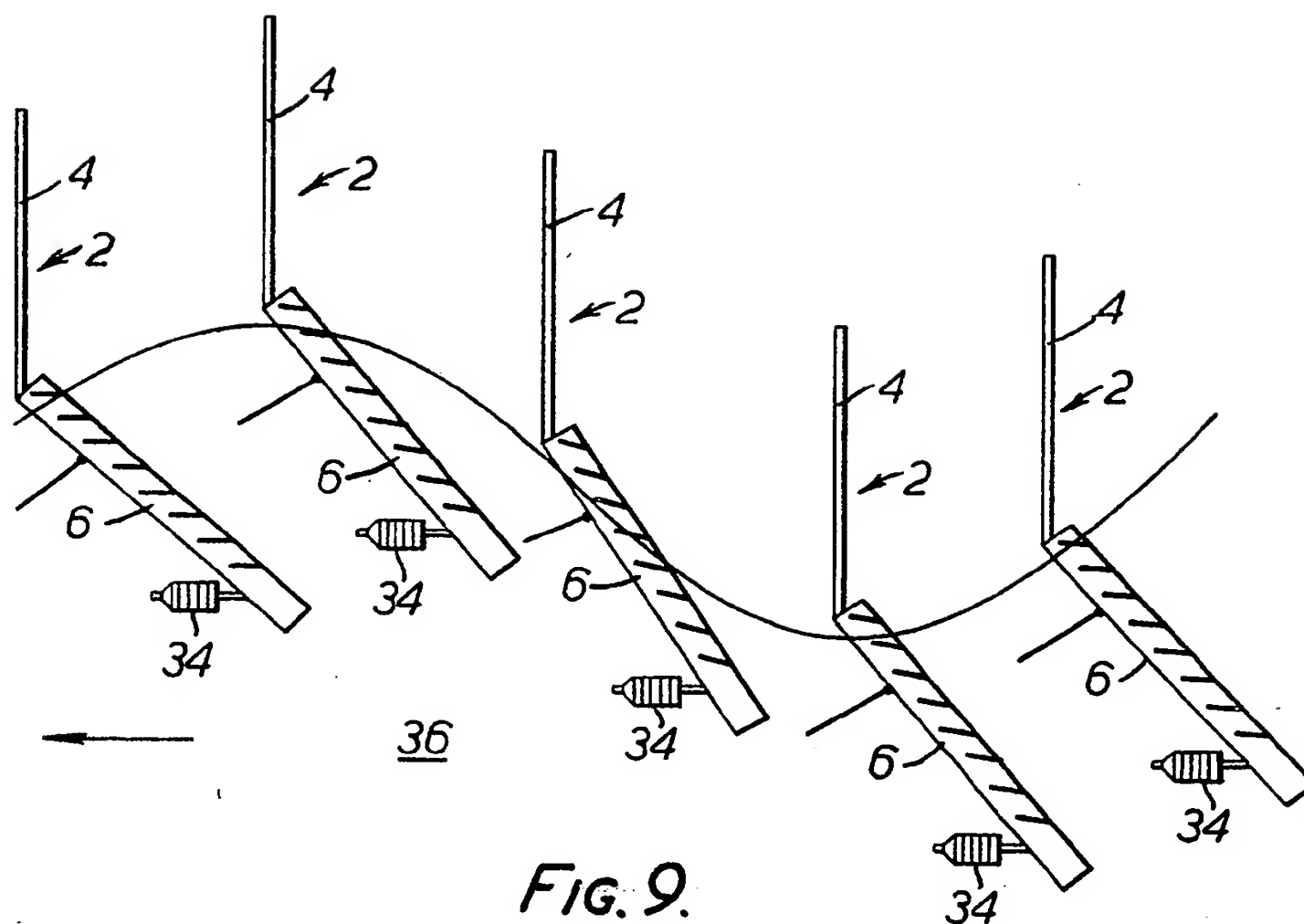


FIG. 9.

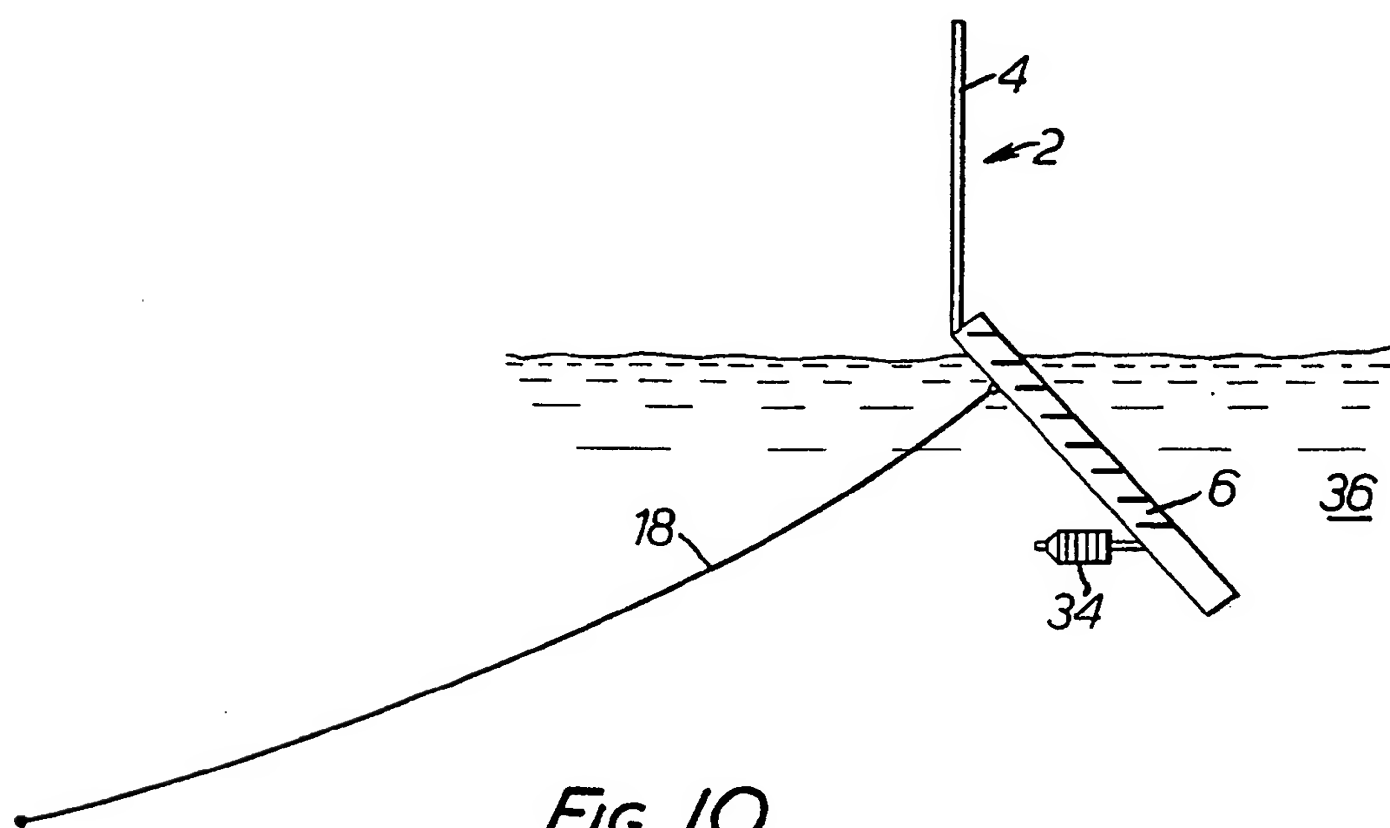
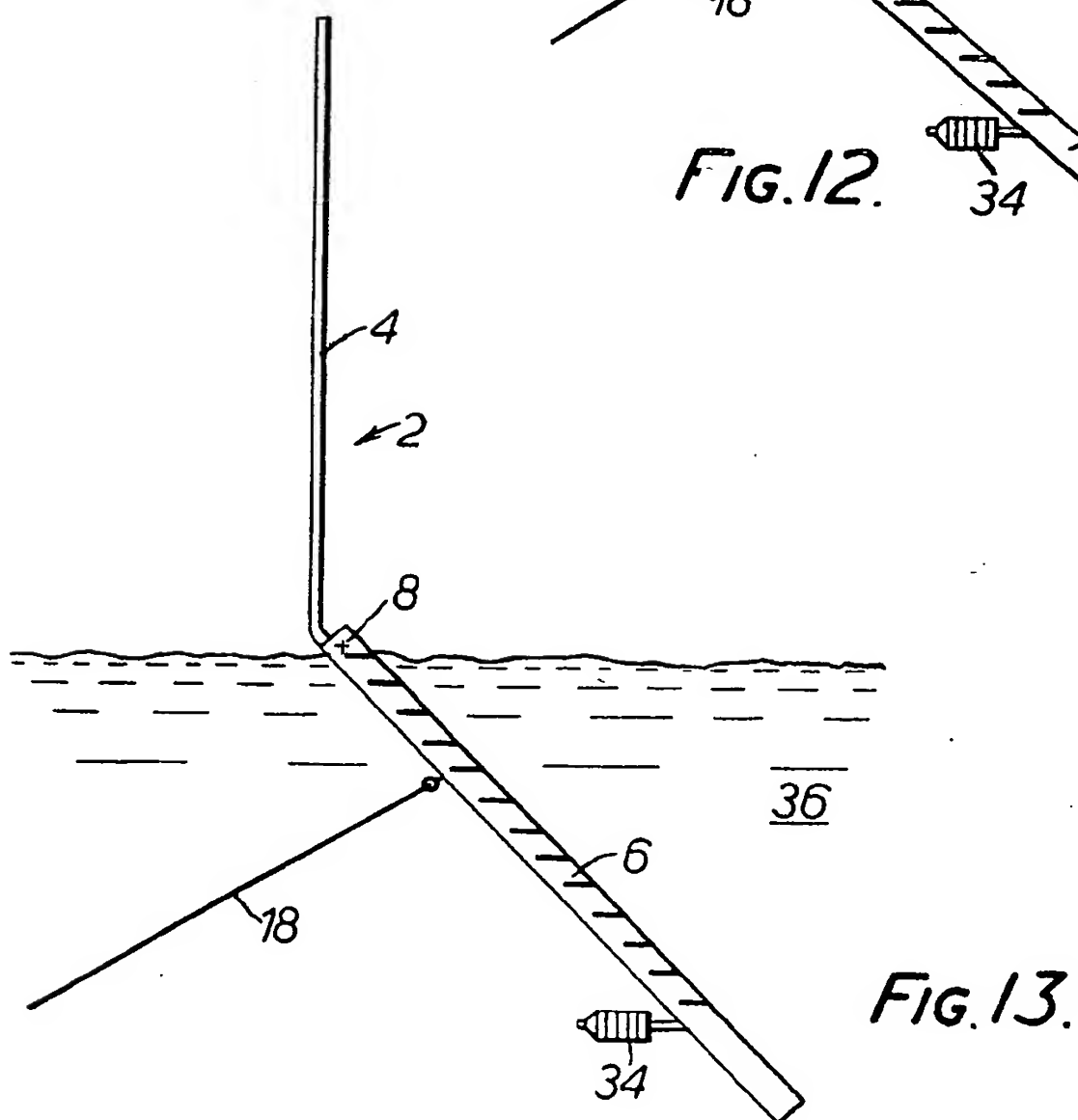
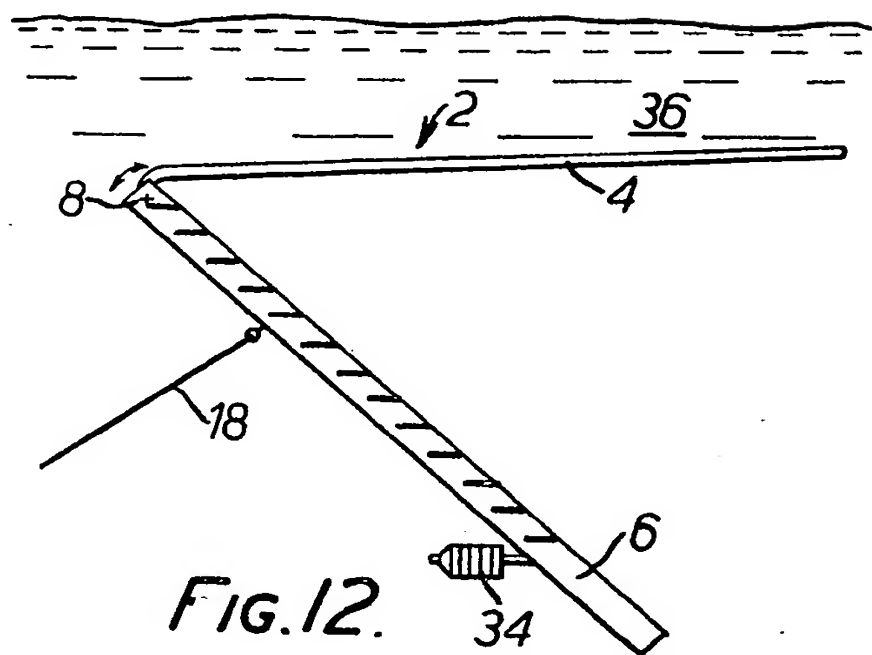
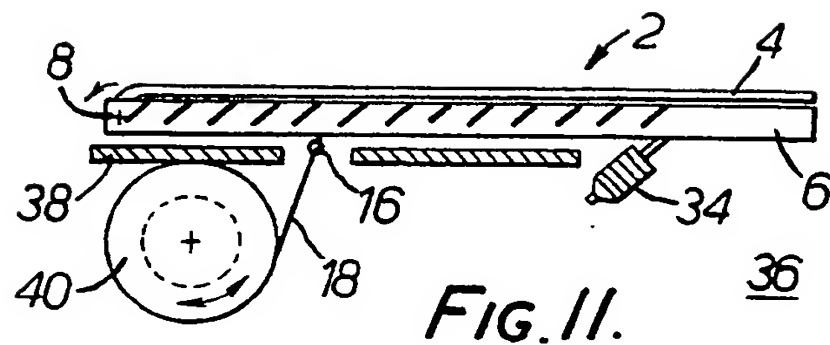


FIG. 10.



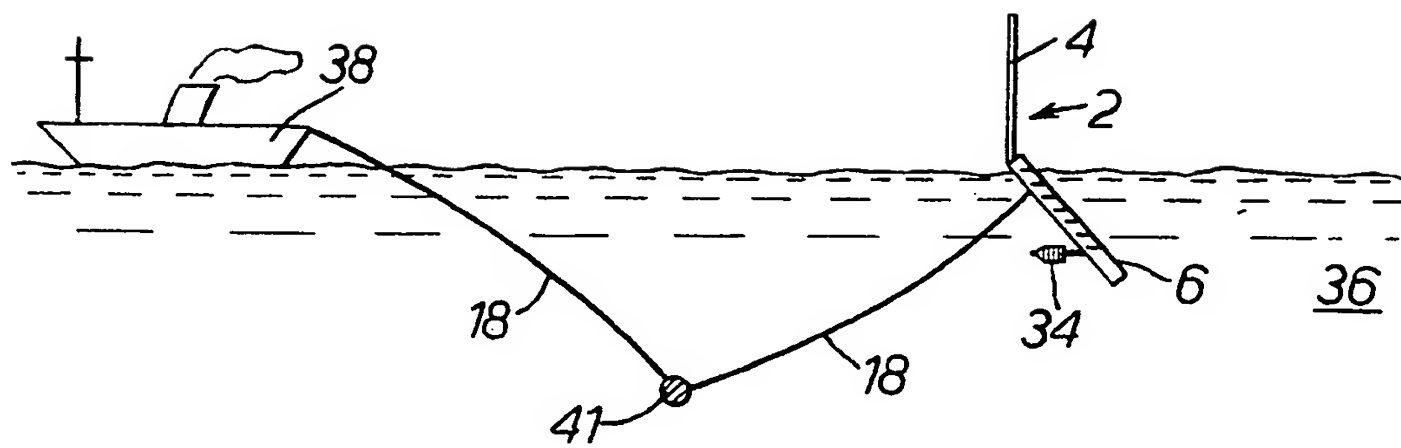


FIG. 14.

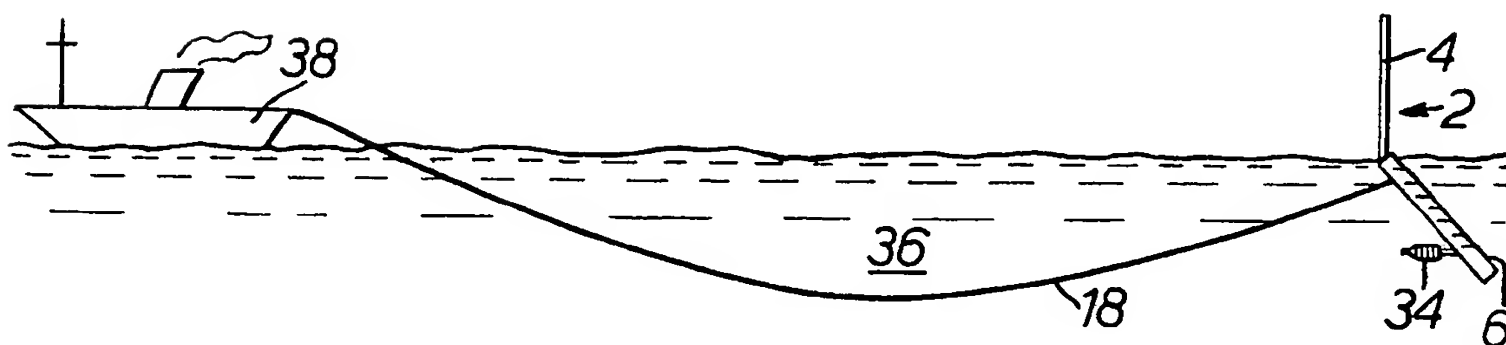


FIG. 15.



## SPECIFICATION

## Hydrodynamic Devices

This invention relates to a hydrodynamic device.

More specifically, this invention relates to a

- 5 hydrodynamic device comprising first and second parts which are connected together such that the first part is movable from a storage position in which it lies adjacent to the second part to an operable position in which it upstands from and extends from one end portion of the second part, the second part comprising an elongate member having (a) a plurality of transversely extending hydrofoil elements, and (b) towing means for enabling a connection to be made between the
- 10 hydrodynamic device and a towing vessel whereby the hydrodynamic device can be towed in water with the first part visible above the water and the second part submerged.
- 15 The hydrodynamic device of the invention is designed so that it can be towed through the water without creating much wake. The hydrodynamic device is also designed to be vertically stable in use so that it can operate in high sea conditions. The device is non-buoyant in water and its characteristics are controlled by its second part which is thus hydrodynamically more important than its first part.

- 20 Preferably, the first and second parts are connected together by a sprung hinge arrangement. Such an arrangement allows the first part to easily and automatically move from its stored position to its upstanding operable position. Alternative arrangements for connecting the first and second parts together include a
- 25 simple pivot whereby the first part can be moved from its stored position to its upstanding position merely by the use of appropriate hydrodynamic and aerodynamic vanes or by a counter balance weight system.

- 30 Advantageously, the first and second parts are so connected together that the first part lies substantially exactly flat. In order to achieve this, the precise arrangement by which the first and second parts are connected together may include auxiliary means such for example as a push rod which engages on a storage platform for getting the first part in the desired substantially flat condition.

- 35 Preferably, the hydrofoil elements are spaced apart by spacer elements.

- 40 The pair of hydrofoil elements that are uppermost when the device is being towed through the water may be provided with drag vanes for controlling the depth at which the second part is submerged. The drag vanes make the hydrodynamic device very sensitive to small depth variations.

- 45 Preferably, the towing means is a towing eye but it is to be appreciated that other devices can be employed.

The first part may be constituted by an aerial, a marker, a target or a radar reflector.

The hydrodynamic device may include weighting means, for example positioned on the

- 50 end portion of the second part that is remote from the first part, for stabilizing the hydrodynamic device and for causing it to tow in a vertical or an included position.

- 55 Embodiments of the invention will now be described solely by way of example and with reference to the accompanying drawings in which:

- 60 Figure 1 is a side view of a first hydrodynamic device in accordance with the invention;

- 65 Figure 2 is an end view of the device shown in Figure 1;

- 70 Figures 3 and 4 show detailed parts of the device shown in Figure 1;

- 75 Figure 5 is a side view of a second hydrodynamic device in accordance with the invention;

- 80 Figure 6 is an end view of the device shown in Figure 5;

- 85 Figures 7 and 8 show detailed parts of the device shown in Figure 5;

- 90 Figures 9 and 10 show the device somewhat schematically as it is being towed through water;

- 95 Figure 11 shows the device of Figure 5 in a stowed position;

- 100 Figure 12 shows the device of Figure 5 in a partially open position;

- 105 Figure 13 shows the device of Figure 5 in its fully expanded position; and

- 110 Figures 14 and 15 show two methods of towing the hydrodynamic device illustrated in Figure 5.

- Referring to Figures 1 to 4, there is shown a hydrodynamic device 2 comprising a first part 4 in the form of a flexible aerial, and a second part 6.

- 115 The first and second parts 4, 6 are connected together by a hinge arrangement located at position 8, the hinge arrangement being such that the first part 4 is movable from a storage position in which it lies adjacent to the second part 6 to an operable position in which it upstands from and extends from an end portion 6A of the second part 6.

- The second part 6 comprises an elongate member having a plurality of transversely extending hydrofoil elements 10 positioned on a shaped elongate fairing member 12 which reacts with the water flow in a manner which gives the device vertical stability. The second part 6 further comprises towing means in the form of a tow bar 14 for enabling a connection to be made between the hydrodynamic device 2 and a towing vessel (not shown) whereby the hydrodynamic device can be towed in water with the first part visible above the water and the second part submerged.
- 120 The tow bar 14 is provided at one end with a towing eye 16 for receiving a tow line 18 and at the other end a pivot 17 allowing freedom of rotation of the tow bar 14 about a shaft 26 in the elongate member.

- 125 Positioned beneath the tow bar 14 are a plurality of weights 20, 22, 24 which are attached to the shaft 26 and which are effective to balance the hydrodynamic device 2. Positioned aft of the

weight 24 and on a shaft 28 is a rectangular damper plate 30.

As shown most clearly in Figure 2, three drag vanes 32 are provided between the two

5 uppermost hydrofoil elements 10. These drag vanes 32 are effective to control the depth at which the second part 6 is submerged. The drag vanes 32 make the hydrodynamic device 2 very sensitive to small depth variations, such that it  
10 can follow water surface wave profiles.

Referring now to Figures 5 to 8, similar parts as in Figures 1 to 4 have been given the same reference numeral and their construction and operation will not again be given in order to avoid  
15 undue repetition of description.

It will be noted that the hydrodynamic device 2 illustrated in Figures 5 to 8 has a smaller tow bar 14 than in the hydrodynamic device 2 illustrated in Figures 1 to 4 and that the tow bar pivot 17 is  
20 no longer required. Also, in the hydrodynamic device 2 illustrated in Figures 5 to 8, only a single weight 34 is employed and there are no drag vanes 32 or damper plate 30.

In Figure 9, there are shown a plurality of the hydrodynamic devices 2 illustrated in Figures 5 to 8, these devices 2 being illustrated as they follow the wave profile of the sea 36.

In Figure 10, the hydrodynamic device 2 is shown attached to a 50 foot tow line 18 and the depth of tow can vary from 0 to 20 feet. The speed of tow can vary, depending upon the structural strength of the device 2, from 3 to 20 knots for example.

In Figure 11, the hydrodynamic device 2 illustrated in Figures 5 to 8 is shown in its stored position in which the first part 4 is lying adjacent the second part 6. The second part 6 is in fact stored on a platform 38 and the tow line 18 is wound around a winch drum 40. As the cable 18  
40 is unwound from the drum 40, then the hydrodynamic device 2 unfolds as illustrated in Figures 12 and 13, Figure 12 illustrating an intermediate unfolded position and Figure 13 illustrating the fully unfolded position. The platform 38 can be submerged so that the hydrodynamic device 2 can be launched substantially automatically from a submerged condition.

Referring now to Figures 14 and 15, the hydrodynamic device 2 illustrated in Figures 5 to 8 is shown being towed by a vessel 38. In Figure 14, a sinker or depressor device 40 is attached to the tow line 18 so that the device is much closer to the vessel in Figure 14 than in Figure 15 where the sinker or depressor device 41 is not employed.

It is to be appreciated that the embodiments of the invention described above have been given by way of example only and that modifications may  
60 be effected. Thus, for example, the weighting arrangements 20, 22, 24 or 34 can be built into the second part 6 to form a part of the second part 6. Also, the first part 4 of the hydrodynamic

device 2 has been illustrated as a flexible aerial but this first part 4 of the hydrodynamic device 2 could also be a marker device, a target or a radar reflector. Also, different types of hinge 8 can be employed. If the first part 4 is small than a rigid attachment to part 6 such that it becomes merely  
70 an extension to the top of the main part 6 could be envisaged.

#### Claims

1. A hydrodynamic device comprising first and second parts which are connected together such that the first part is movable from a storage position in which it lies adjacent to the second part to an operable position in which it upstands from and extends from one end portion of the second part, the second part comprising an elongate member having (a) a plurality of transversely extending hydrofoil elements, and (b) towing means for enabling a connection to be made between the hydrodynamic device and a towing vessel whereby the hydrodynamic device  
80 can be towed in water with the first part visible above the water and the second part submerged.

2. A hydrodynamic device according to claim 1 in which the first and second parts are connected together by a sprung hinge arrangement.

3. A hydrodynamic device according to claim 1 or claim 2 in which the first and second parts are so connected together that the first part lies substantially exactly flat.

4. A hydrodynamic device according to any one of the preceding claims in which the hydrofoil elements are spaced apart by spacer elements.

5. A hydrodynamic device according to any one of the preceding claims in which the pair of hydrofoil elements that are uppermost when the device is being towed through the water are provided with drag vanes for controlling the depth at which the second part is submerged.

6. A hydrodynamic device according to any one of the preceding claims in which the towing means is a towing eye.

7. A hydrodynamic device according to any one of the preceding claims including weighting means for stabilizing the hydrodynamic device and for causing it to tow in a vertical or an inclined position.

8. A hydrodynamic device according to claim 7 in which the weighting means is positioned on the end portion of the second part that is remote from the first part.

9. A hydrodynamic device substantially as herein described with reference to the accompanying drawings.

New claims or amendments to claims filed on 28/8/79.

120 Superseded claims 1.

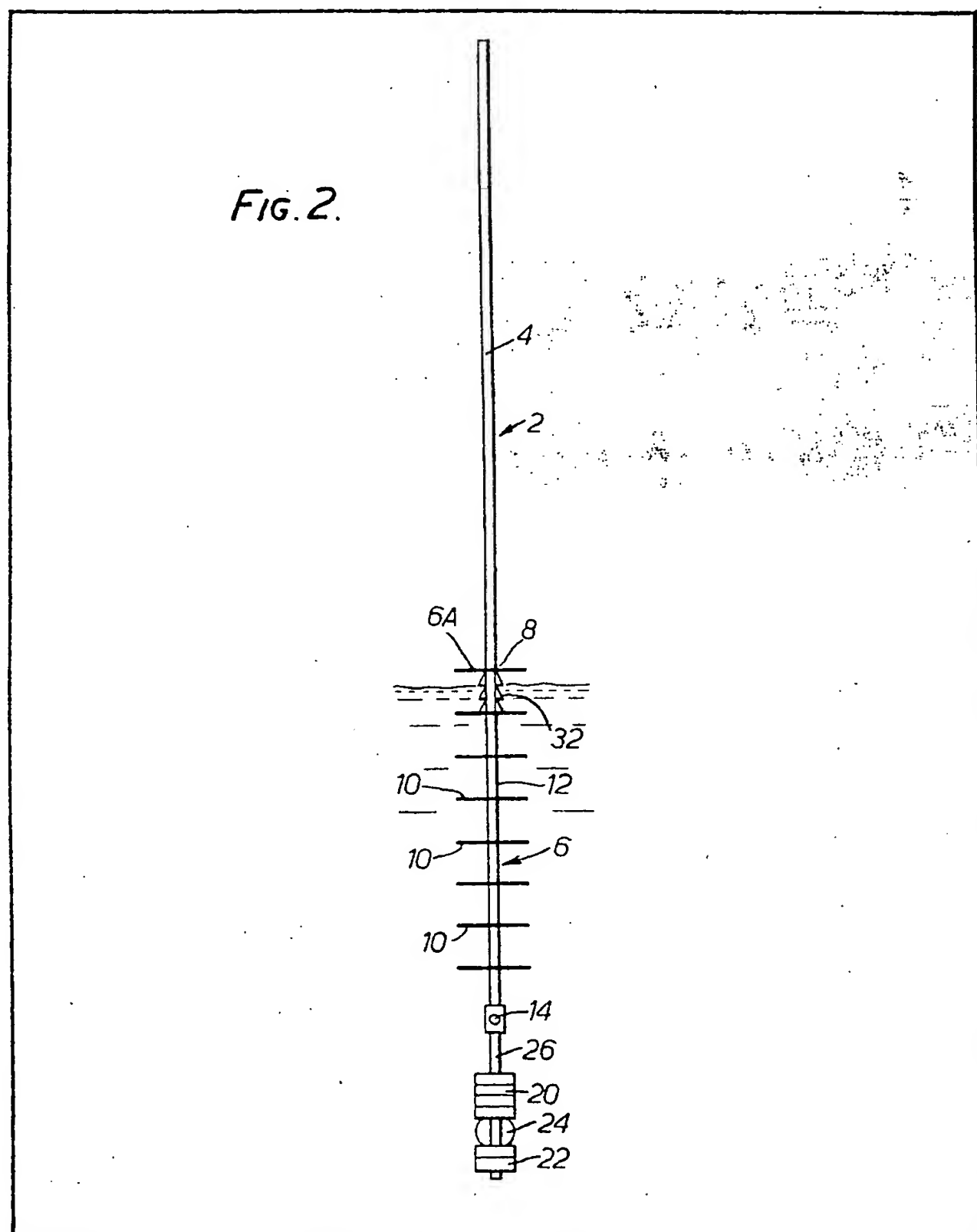
#### New or Amended Claims:—1

"hydrofoil" on line 9 of claim 1 should read "hydrofoil"

- ### (54) Hydrodynamic Devices

(57) A hydrodynamic device 2 comprising first and second parts 4, 6 which are connected together such that the first part is movable from a storage position in which it lies adjacent to the second part to an operable position in which it upstands from and extends from one end

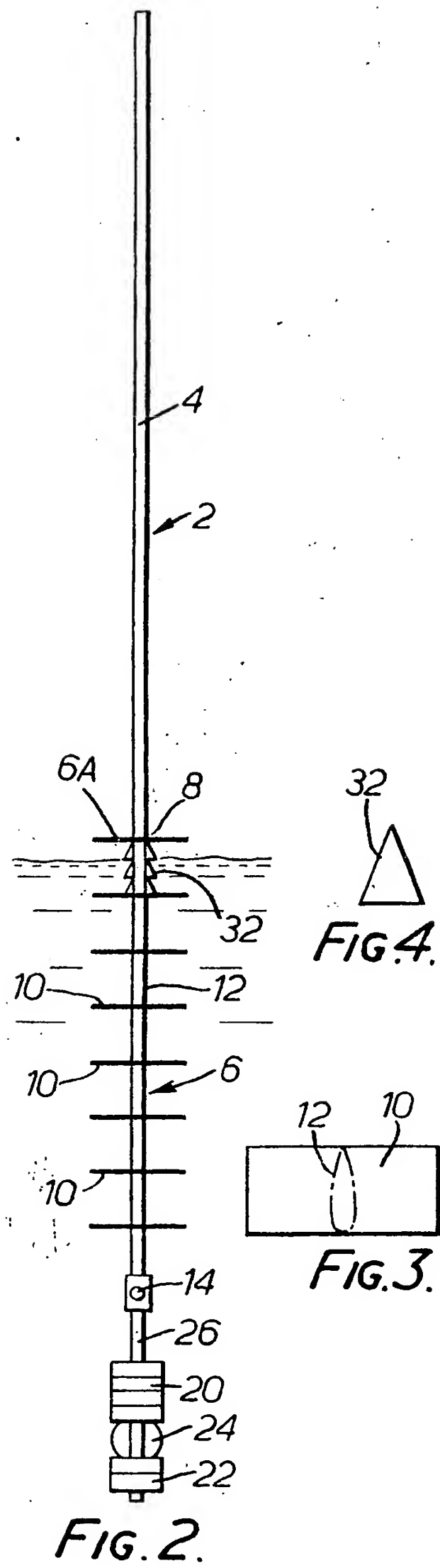
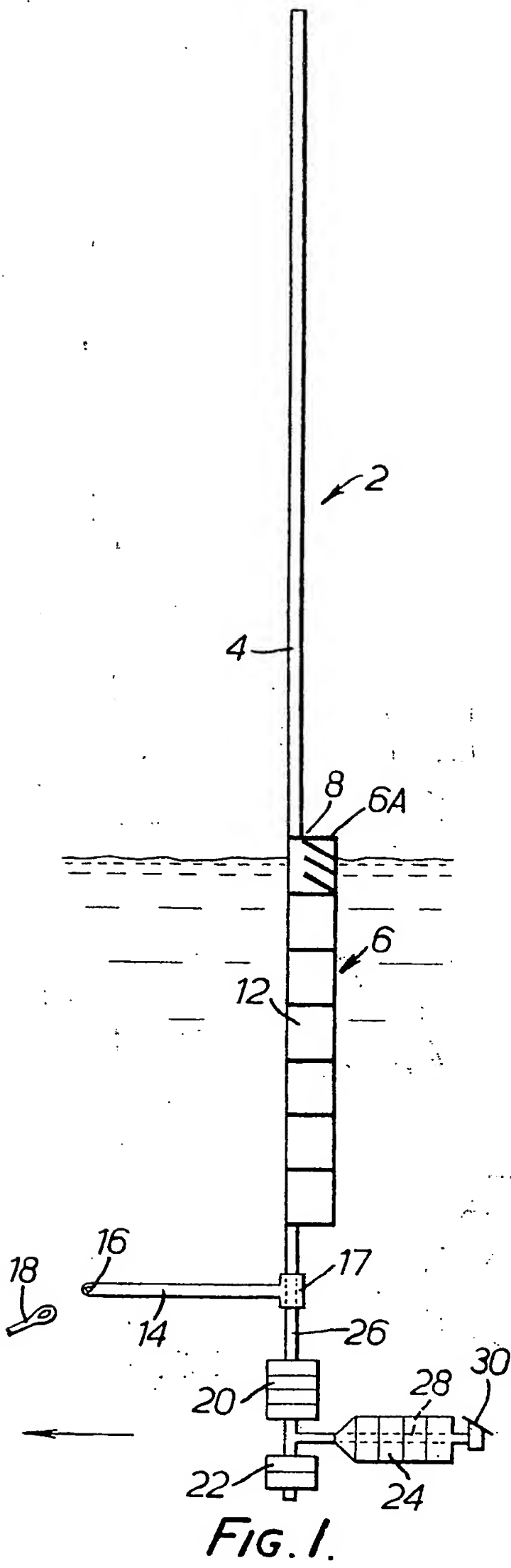
portion of the second part, the second part comprising an elongate member having (a) a plurality of transversely extending hydrofoil elements 10, and (b) towing means 14 for enabling a connection to be made between the hydrodynamic device and a towing vessel whereby the hydrodynamic device can be towed in water with the first part visible above the water and the second part submerged.



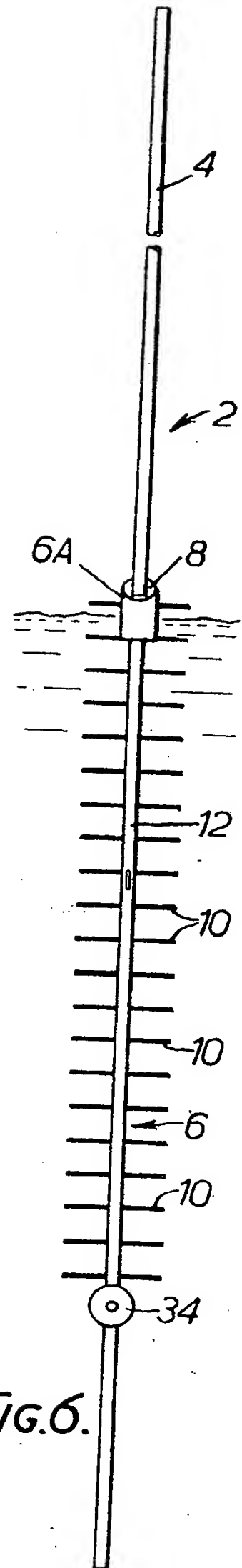
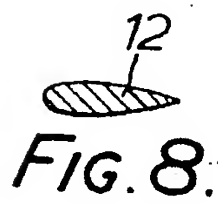
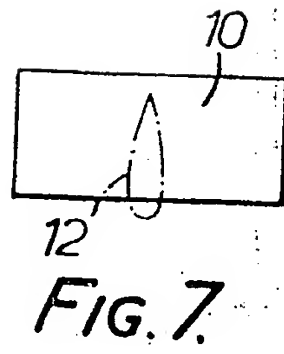
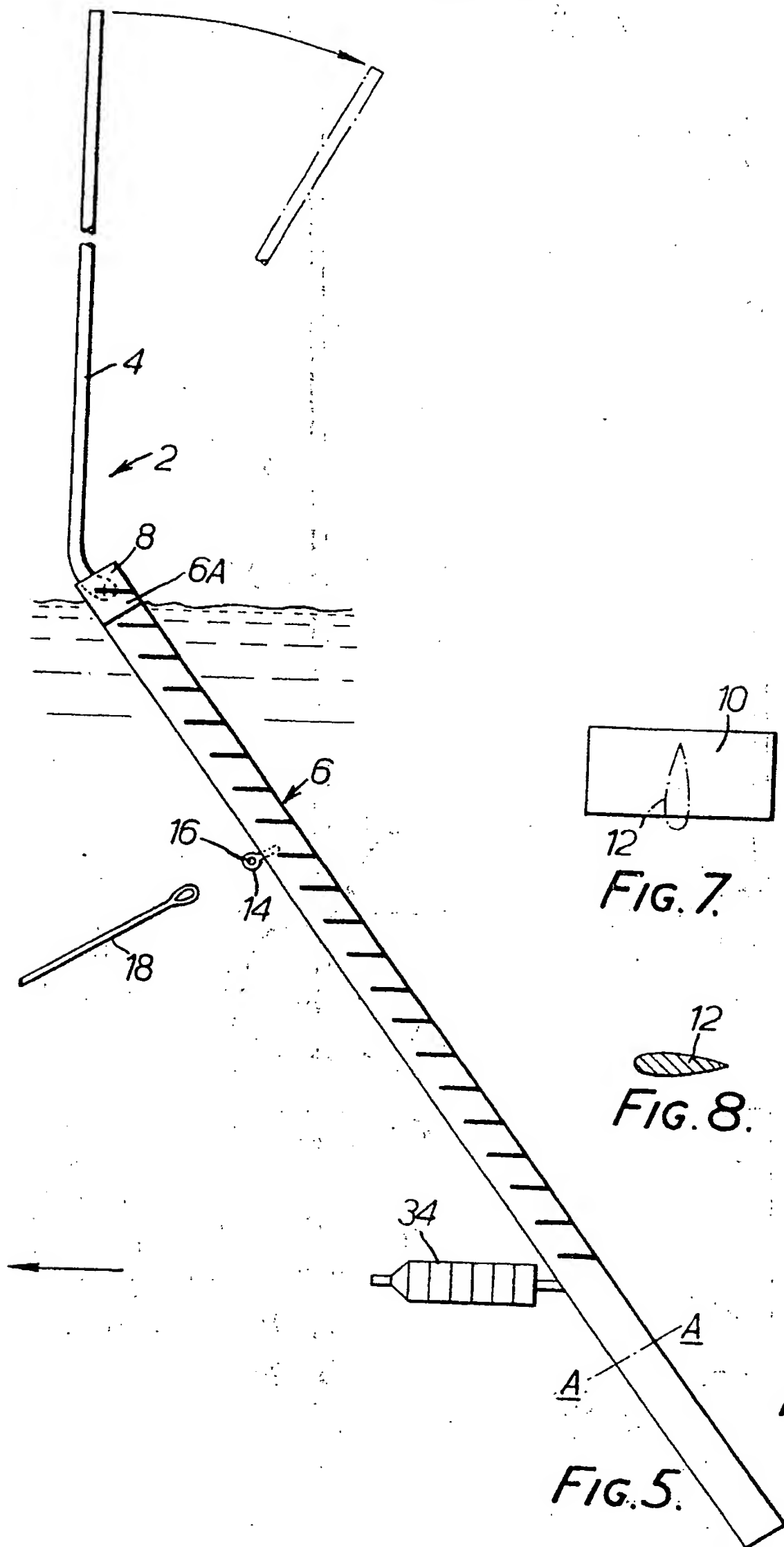
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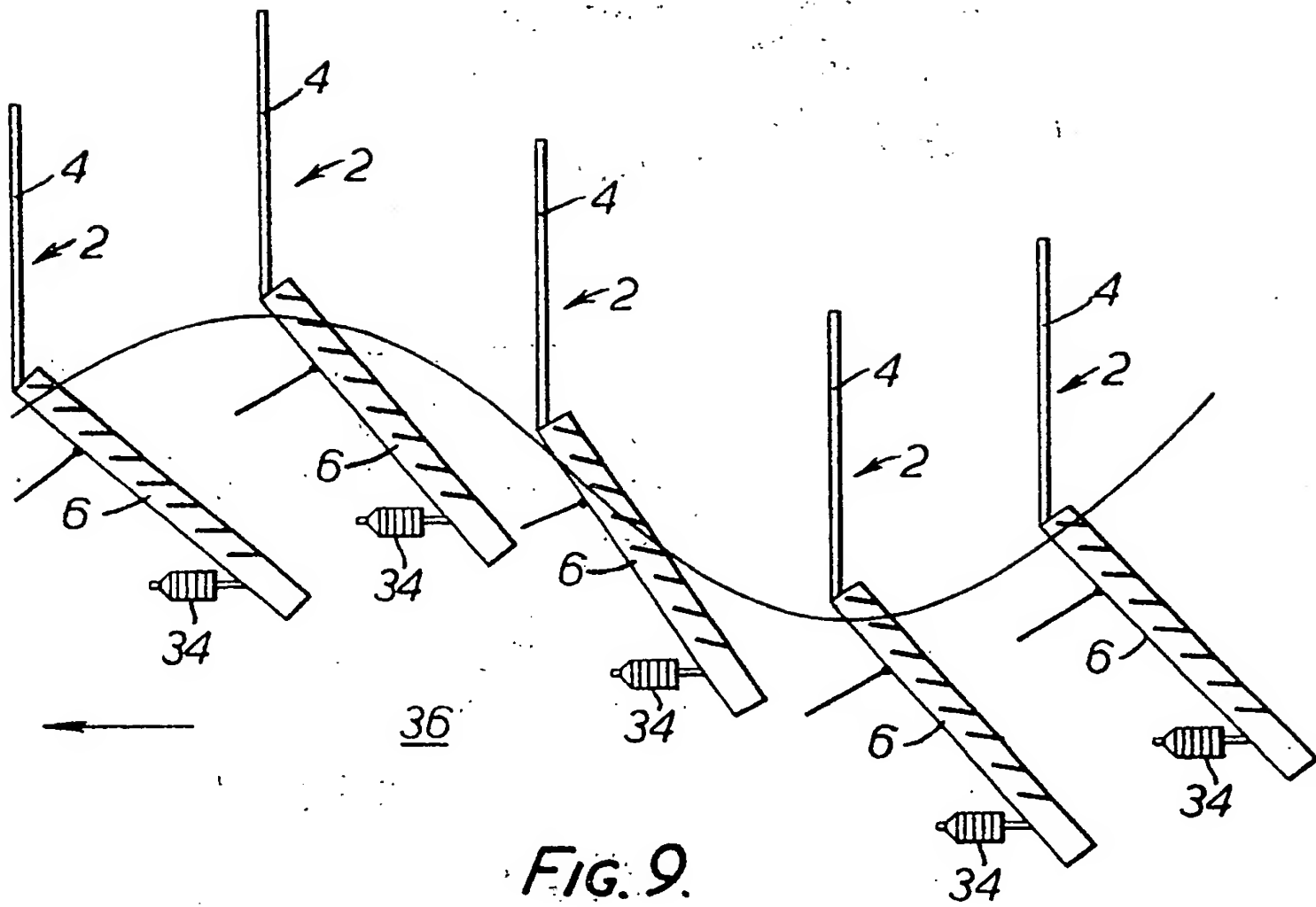


FIG. 9.

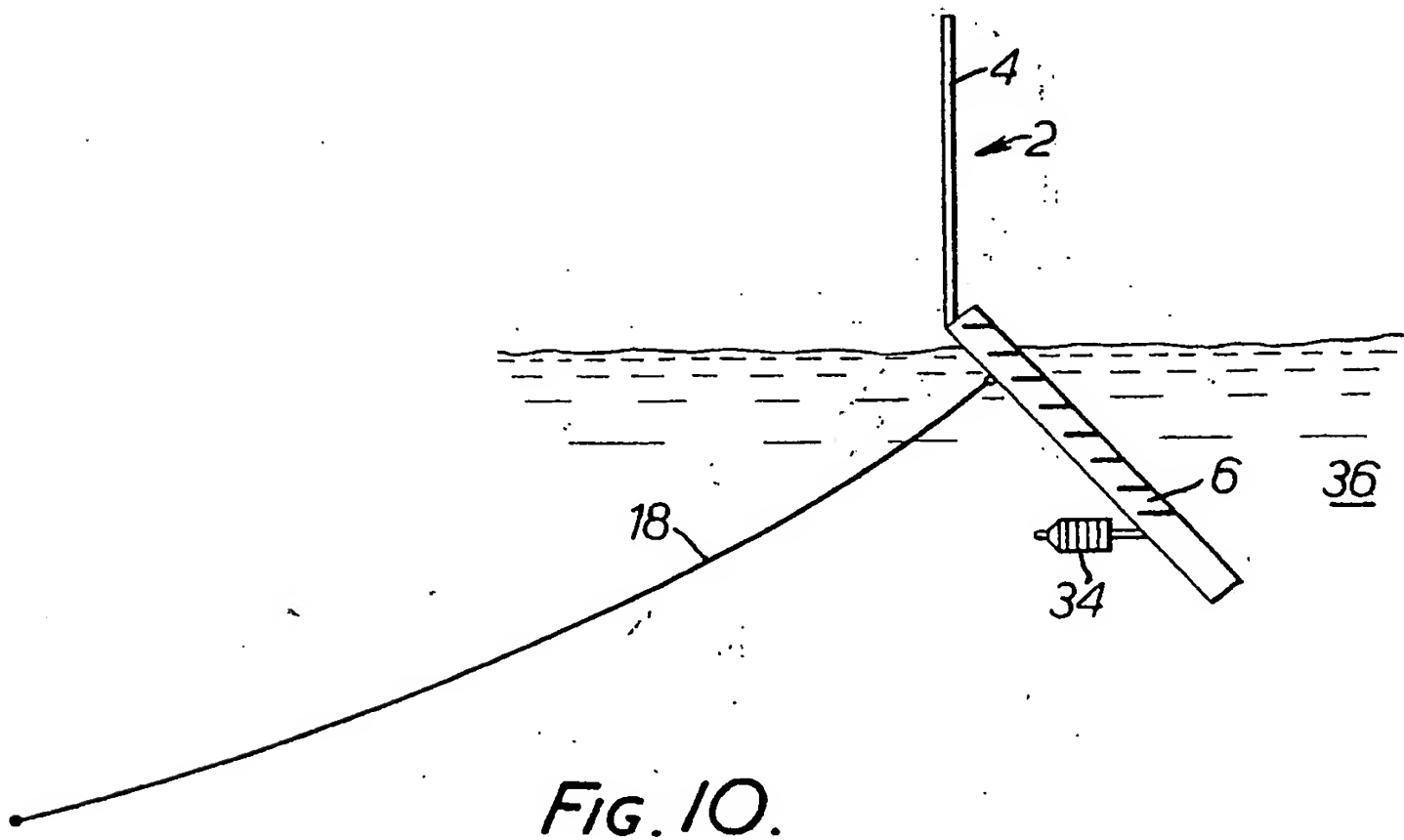


FIG. 10.

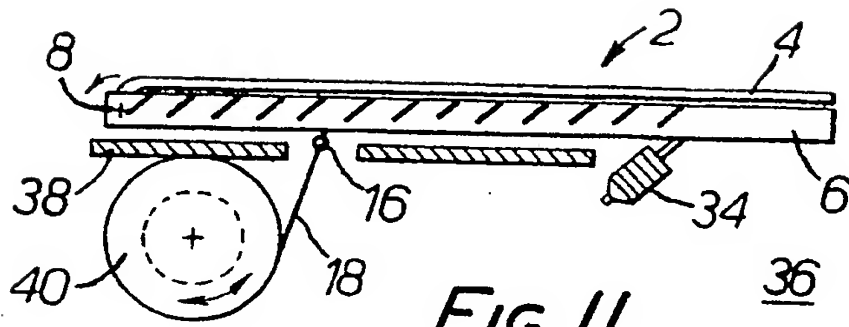


FIG. 11.

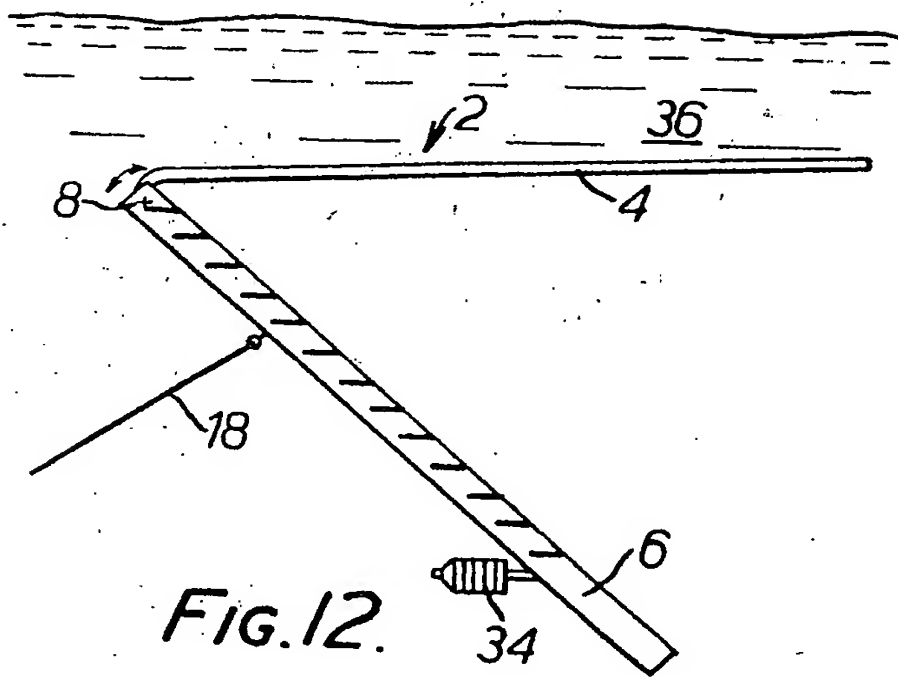


FIG. 12.

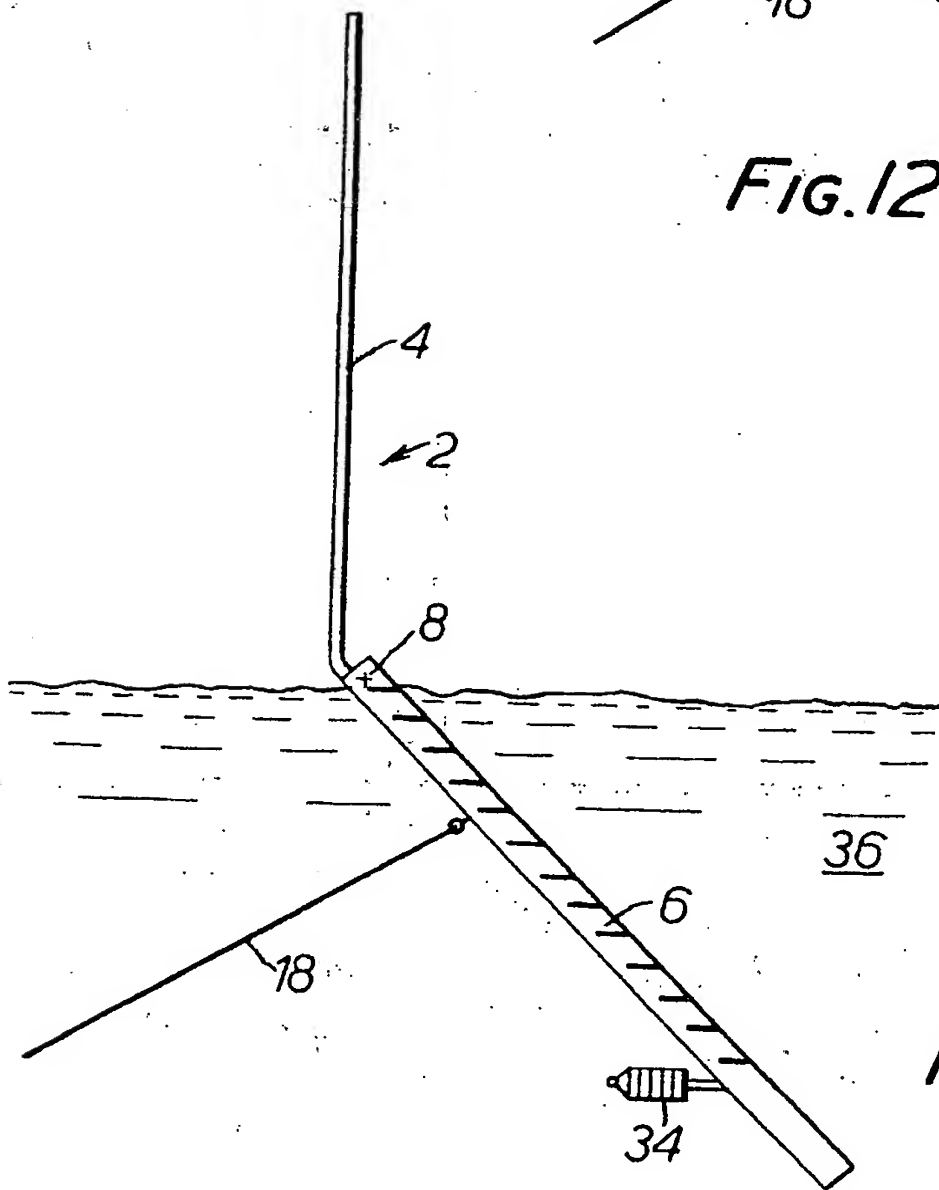


FIG. 13.

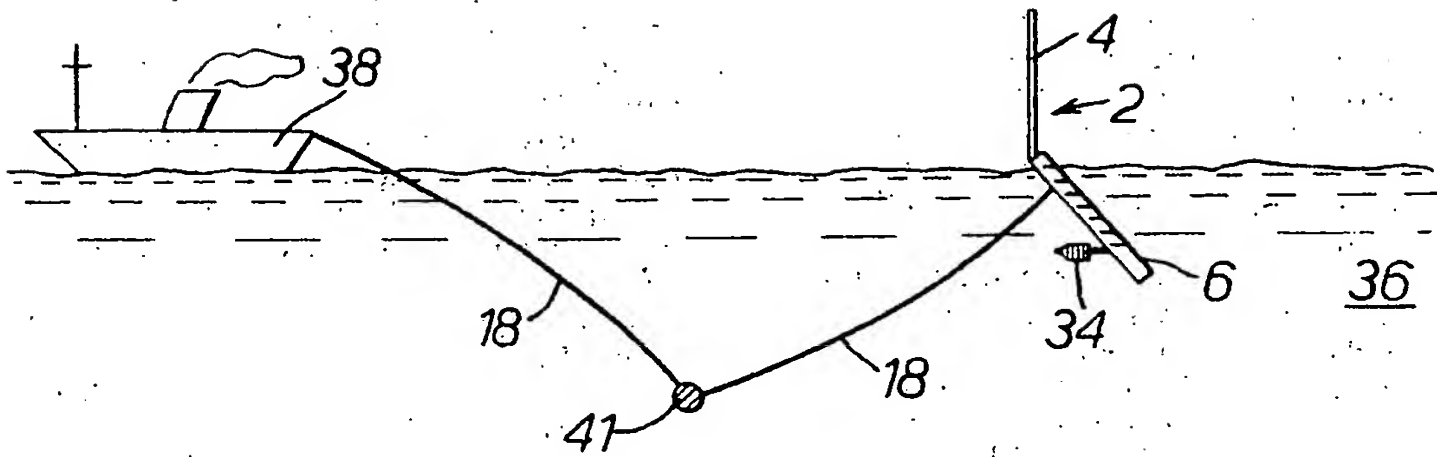


FIG. 14.

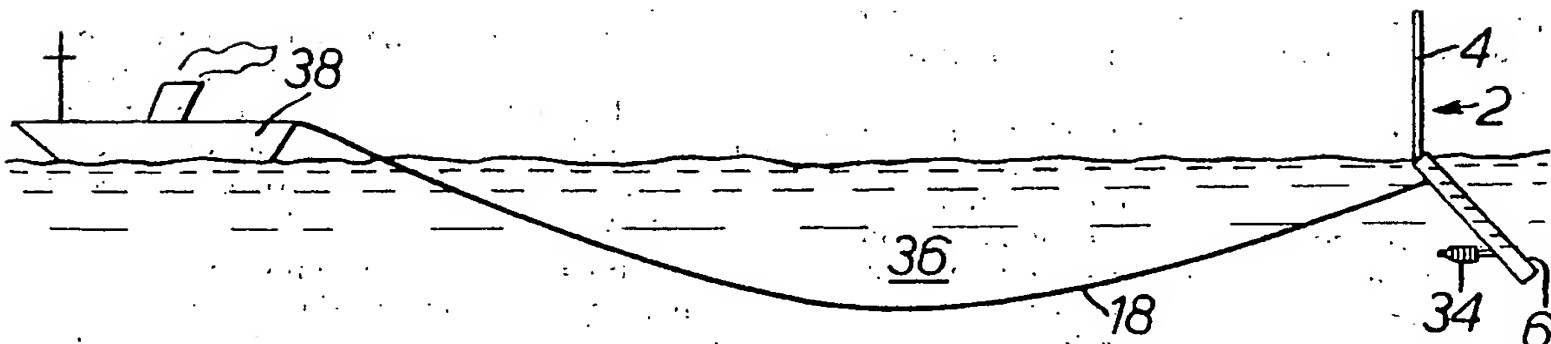


FIG. 15.



## SPECIFICATION

### Hydrodynamic Devices

This invention relates to a hydrodynamic device.

More specifically, this invention relates to a  
5 hydrodynamic device comprising first and second  
parts which are connected together such that the  
first part is movable from a storage position in  
which it lies adjacent to the second part to an  
10 operable position in which it upstands from and  
extends from one end portion of the second part,  
the second part comprising an elongate member  
having (a) a plurality of transversely extending  
hydrofoil elements, and (b) towing means for  
15 enabling a connection to be made between the  
hydrodynamic device and a towing vessel  
whereby the hydrodynamic device can be towed  
in water with the first part visible above the water  
and the second part submerged.

The hydrodynamic device of the invention is  
20 designed so that it can be towed through the  
water without creating much wake. The  
hydrodynamic device is also designed to be  
vertically stable in use so that it can operate in  
high sea conditions. The device is non-buoyant in  
25 water and its characteristics are controlled by its  
second part which is thus hydrodynamically more  
important than its first part.

Preferably, the first and second parts are  
connected together by a sprung hinge  
30 arrangement. Such an arrangement allows the  
first part to easily and automatically move from its  
stored position to its upstanding operable  
position. Alternative arrangements for connecting  
the first and second parts together include a  
35 simple pivot whereby the first part can be moved  
from its stored position to its upstanding position  
merely by the use of appropriate hydrodynamic  
and aerodynamic vanes or by a counter balance  
weight system.

40 Advantageously, the first and second parts are  
so connected together that the first part lies  
substantially exactly flat. In order to achieve this,  
the precise arrangement by which the first and  
second parts are connected together may include  
45 auxiliary means such for example as a push rod  
which engages on a storage platform for getting  
the first part in the desired substantially flat  
condition.

Preferably, the hydrofoil elements are spaced  
50 apart by spacer elements.

The pair of hydrofoil elements that are  
uppermost when the device is being towed  
through the water may be provided with drag  
vanes for controlling the depth at which the  
55 second part is submerged. The drag vanes make  
the hydrodynamic device very sensitive to small  
depth variations.

Preferably, the towing means is a towing eye  
but it is to be appreciated that other devices can  
60 be employed.

The first part may be constituted by an aerial, a  
marker, a target or a radar reflector.

The hydrodynamic device may include  
weighting means, for example positioned on the

65 end portion of the second part that is remote from  
the first part, for stabilizing the hydrodynamic  
device and for causing it to tow in a vertical or an  
inclined position.

Embodiments of the invention will now be  
70 described solely by way of example and with  
reference to the accompanying drawings in  
which:

Figure 1 is a side view of a first hydrodynamic  
device in accordance with the invention;

75 Figure 2 is an end view of the device shown in  
Figure 1;

Figures 3 and 4 show detailed parts of the  
device shown in Figure 1;

80 Figure 5 is a side view of a second  
hydrodynamic device in accordance with the  
invention;

Figure 6 is an end view of the device shown in  
Figure 5;

85 Figures 7 and 8 show detailed parts of the  
device shown in Figure 5;

Figures 9 and 10 show the device somewhat  
schematically as it is being towed through water;

Figure 11 shows the device of Figure 5 in a  
stowed position;

90 Figure 12 shows the device of Figure 5 in a  
partially open position;

Figure 13 shows the device of Figure 5 in its  
fully expanded position; and

95 Figures 14 and 15 show two methods of  
towing the hydrodynamic device illustrated in  
Figure 5.

Referring to Figures 1 to 4, there is shown a  
hydrodynamic device 2 comprising a first part 4 in  
the form of a flexible aerial, and a second part 6.  
100 The first and second parts 4, 6 are connected  
together by a hinge arrangement located at  
position 8, the hinge arrangement being such that  
the first part 4 is movable from a storage position  
in which it lies adjacent to the second part 6 to an  
105 operable position in which it upstands from and  
extends from an end portion 6A of the second  
part 6.

The second part 6 comprises an elongate  
member having a plurality of transversely  
110 extending hydrofoil elements 10 positioned on a  
shaped elongate fairing member 12 which reacts  
with the water flow in a manner which gives the  
device vertical stability. The second part 6 further  
comprises towing means in the form of a tow bar  
115 14 for enabling a connection to be made between  
the hydrodynamic device 2 and a towing vessel  
(not shown) whereby the hydrodynamic device  
can be towed in water with the first part visible  
above the water and the second part submerged.  
120 The tow bar 14 is provided at one end with a  
towing eye 16 for receiving a tow line 18 and at  
the other end a pivot 17 allowing freedom of  
rotation of the tow bar 14 about a shaft 26 in the  
elongate member.

125 Positioned beneath the tow bar 14 are a  
plurality of weights 20, 22, 24 which are attached  
to the shaft 26 and which are effective to balance  
the hydrodynamic device 2. Positioned aft of the

weight 24 and on a shaft 28 is a rectangular damper plate 30.

As shown most clearly in Figure 2, three drag vanes 32 are provided between the two uppermost hydrofoil elements 10. These drag vanes 32 are effective to control the depth at which the second part 6 is submerged. The drag vanes 32 make the hydrodynamic device 2 very sensitive to small depth variations, such that it can follow water surface wave profiles.

Referring now to Figures 5 to 8, similar parts as in Figures 1 to 4 have been given the same reference numeral and their construction and operation will not again be given in order to avoid undue repetition of description.

It will be noted that the hydrodynamic device 2 illustrated in Figures 5 to 8 has a smaller tow bar 14 than in the hydrodynamic device 2 illustrated in Figures 1 to 4 and that the tow bar pivot 17 is no longer required. Also, in the hydrodynamic device 2 illustrated in Figures 5 to 8, only a single weight 34 is employed and there are no drag vanes 32 or damper plate 30.

In Figure 9, there are shown a plurality of the hydrodynamic devices 2 illustrated in Figures 5 to 8, these devices 2 being illustrated as they follow the wave profile of the sea 36.

In Figure 10, the hydrodynamic device 2 is shown attached to a 50 foot tow line 18 and the depth of tow can vary from 0 to 20 feet. The speed of tow can vary, depending upon the structural strength of the device 2, from 3 to 20 knots for example.

In Figure 11, the hydrodynamic device 2 illustrated in Figures 5 to 8 is shown in its stored position in which the first part 4 is lying adjacent the second part 6. The second part 6 is in fact stored on a platform 38 and the tow line 18 is wound around a winch drum 40. As the cable 18 is unwound from the drum 40, then the hydrodynamic device 2 unfolds as illustrated in Figures 12 and 13, Figure 12 illustrating an intermediate unfolded position and Figure 13 illustrating the fully unfolded position. The platform 38 can be submerged so that the hydrodynamic device 2 can be launched substantially automatically from a submerged condition.

Referring now to Figures 14 and 15, the hydrodynamic device 2 illustrated in Figures 5 to 8 is shown being towed by a vessel 38. In Figure 14, a sinker or depressor device 40 is attached to the tow line 18 so that the device is much closer to the vessel in Figure 14 than in Figure 15 where the sinker or depressor device 41 is not employed.

It is to be appreciated that the embodiments of the invention described above have been given by way of example only and that modifications may be effected. Thus, for example, the weighting arrangements 20, 22, 24 or 34 can be built into the second part 6 to form a part of the second part 6. Also, the first part 4 of the hydrodynamic

device 2 has been illustrated as a flexible aerial but this first part 4 of the hydrodynamic device 2 could also be a marker device, a target or a radar reflector. Also, different types of hinge 8 can be employed. If the first part 4 is small than a rigid attachment to part 6 such that it becomes merely an extension to the top of the main part 6 could be envisaged.

#### Claims

1. A hydrodynamic device comprising first and second parts which are connected together such that the first part is movable from a storage position in which it lies adjacent to the second part to an operable position in which it upstands from and extends from one end portion of the second part, the second part comprising an elongate member having (a) a plurality of transversely extending hydrofoil elements, and (b) towing means for enabling a connection to be made between the hydrodynamic device and a towing vessel whereby the hydrodynamic device can be towed in water with the first part visible above the water and the second part submerged.

2. A hydrodynamic device according to claim 1 in which the first and second parts are connected together by a sprung hinge arrangement.

3. A hydrodynamic device according to claim 1 or claim 2 in which the first and second parts are so connected together that the first part lies substantially exactly flat.

4. A hydrodynamic device according to any one of the preceding claims in which the hydrofoil elements are spaced apart by spacer elements.

5. A hydrodynamic device according to any one of the preceding claims in which the pair of hydrofoil elements that are uppermost when the device is being towed through the water are provided with drag vanes for controlling the depth at which the second part is submerged.

6. A hydrodynamic device according to any one of the preceding claims in which the towing means is a towing eye.

7. A hydrodynamic device according to any one of the preceding claims including weighting means for stabilizing the hydrodynamic device and for causing it to tow in a vertical or an inclined position.

8. A hydrodynamic device according to claim 7 in which the weighting means is positioned on the end portion of the second part that is remote from the first part.

9. A hydrodynamic device substantially as herein described with reference to the accompanying drawings.

New claims or amendments to claims filed on 28/8/79.

Superseded claims 1.

#### New or Amended Claims:—1

"hydrofoil" on line 9 of claim 1 should read "hydrofoil"